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ABSTRACT

This activity features students carrying out an outdoor study of a 10-by-10 meter area in which they identify organisms living in the soil, plants, insects, and any other animals living within or immediately adjacent to the site. Groups also examine abiotic factors in the same study site. Students work in teams, share data, and each write a paper responding to a series of questions about the data. (Author/CCM)

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ED 433 241

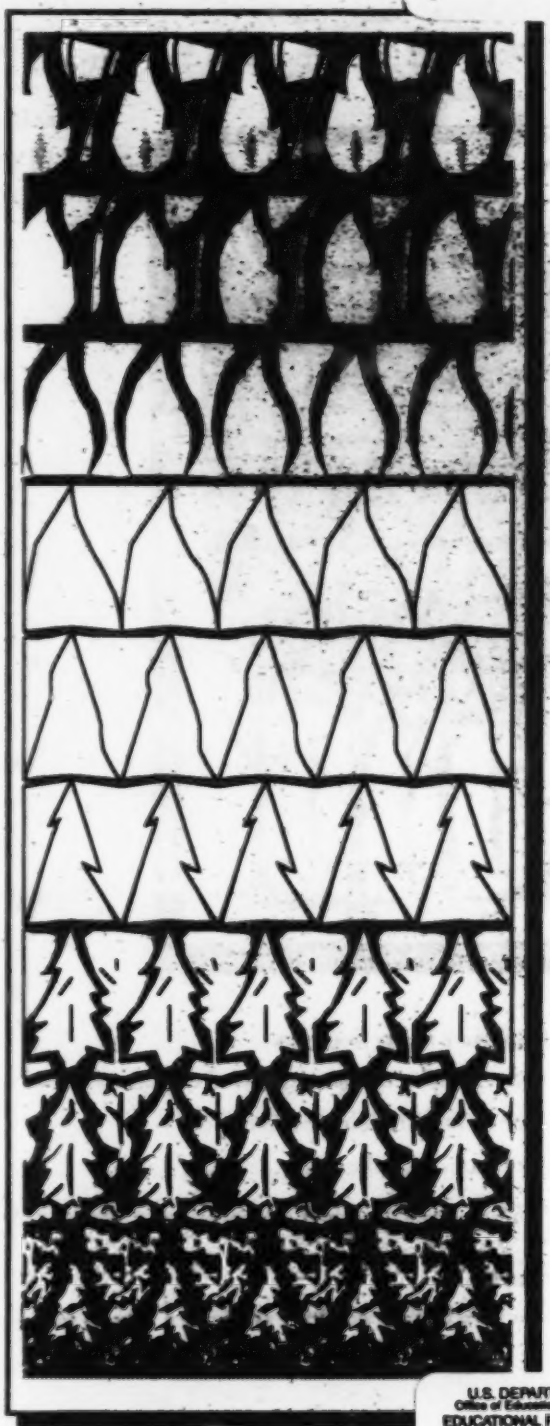
Studying a Piece of an Ecosystem

A High School Biology Class Exercise

Target audience:

- ☒ HS Biology
- ☒ HS Environmental studies

This activity helps students identify the parts of an ecosystem, and how the living and non-living factors interact.



Background information

Notes for the teacher:

This activity is an excellent endpoint for a unit on *ecology*. After teaching about food chains, energy flow, *abiotic* (non-living) and *biotic* (living) factors, and ecological relationships (mutualism, commensalism, predation, parasitism, competition), the students will get a chance to apply the information they have been taught.

Selection of a study site is important. The site does not have to be large, a 10 x 10 m (100 m^2) area is fine, but it should show some diversity of plants, and have some animal life in the area.

An unmowed corner of the campus, a section of trees behind the gym, a local nature center or park, or even a vacant lot down the street can be used. (Try to use a different area for each class so the last classes of the day aren't surveying a trampled-down area.) Be sure to check the site in advance for anything that could harm the students or make walking difficult.

It helps to have written the instructions out for each student. If this is not practical, put the data on the board or on an overhead transparency and have the students copy it.

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Students should have:

- A clipboard (or notebook) to take into the field.
- Guides to plants, insects, birds, mammals.
- Binoculars (one or two pairs can be shared).

Teacher Preparation time:

- One hour to go to study site, checking for problems like uneven terrain, poison ivy, brambles, identifying the major plants present, and looking for examples of ecological relationships, birds, mammals and insects. Look to see where good study sites could be located. A site should be large enough for a few 10 x 10 m squares to be marked off, and must have a variety of vegetation, but not so much that the site is impenetrable.
- Two hours gathering field guides, making direction cards and data sheets, assigning students to groups based on their talents (if you wish to assign rather than ask for volunteers) and gathering other equipment.

Total preparation time: 3 hours.

Class time: 4 to 5 days:

- 1 day to give assignments and explain job
- 2 or 3 days in field gathering data
- 1 day back in classroom sharing data

A week for students to draft and write reports describing the activity.

Abstract:

Students carry out an outdoor study of a 10x10 m area in which they identify organisms living in the soil, plants, insects, and any other animals living within or immediately adjacent to

the site. Groups also examine abiotic factors in the same study site. Students will work in teams, share data, then each will write a paper, responding to a series of questions about the data.

Materials:

- ☒ 8 stakes
- ☒ hammer
- ☒ measuring rope (10m) marked in meters
- ☒ string 60 m long
- ☒ rain gauge
- ☒ soil pH test kit
- ☒ thermometer
- ☒ sling psychrometer
- ☒ relative humidity table
- ☒ rulers
- ☒ wire ring (easily made from a wire coat hanger. It should be about 1 foot in diameter.)
- ☒ trowel
- ☒ binoculars (can be shared)
- ☒ insect nets
- ☒ large Ziploc bags
- ☒ marking pens
- ☒ data sheets
- ☒ pencils
- ☒ instruction cards
- ☒ large enamel pans
- ☒ forceps
- ☒ dissecting scope or magnifying glasses
- ☒ field guides (as appropriate to the site):
  - ☑ insects
  - ☑ trees
  - ☑ flowering plants
  - ☑ ferns

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- ☑ mosses
- ☑ lichens
- ☑ mushrooms
- ☑ birds
- ☑ mammals
- ☑ reptiles
- ☑ amphibians
- ☑ marine life

Procedure:

Select a study site.

Assign students to the following groups, or let them volunteer. All tasks need to be done. The following list gives the name of the group and the procedure for that group (to be written on the directions cards).

- ☒ ***Staking*** (3 students minimum). Using the measuring rope, students will mark a 10 m x 10 m square. Inside the square they should mark off a 2 m x 10 m rectangle, and an 0.5 m x 2 m rectangle. Mark the corners of the square and rectangles with stakes, then connect the stakes with string. (At the end of the period rewind the string and take up the stakes.) (For an illustration and detailed description of the process and alternative ways to study an area of land, see the Department of Environmental Protection booklet: *Classroom and Field Experiments for Florida's Environmental Resources* - Experiment 14.)
- ☒ ***Trees*** (a plant with a stem more than 1 cm. in diameter): Count and identify each type of tree in the 10 m x 10 m square.
- ☒ ***Shrubs*** (a plant with a stem greater that .5 cm. in diameter but less than 1 cm. in diameter): Count and identify each type of shrub in the 2 m x 10 m rectangle.
- ☒ ***Herbs*** (a plant with a stem less than .5 cm in diameter): Count and identify each herb in the 0.5 m x 2 m area.
- ☒ ***Primitive plants*** (ferns, mosses, liverworts, etc.): Count and identify each one in the 0.5 m x 2 m area.
- ☒ ***Soil and litter organisms***: A student should throw a tennis ball, a stone, or other marker over their shoulder into the 10 m x 10 m area. Place the wire ring where

the marker lands (with the marker in the center). Remove all leaf litter from inside the ring and place it in the plastic bag. Label the bag *litter*. Using the trowel, dig up the soil to a depth of 10 cm. Place the soil in another bag, and label it. Using the marker and ring, select two more sites, and repeat the sampling, adding the litter and soil into the already-marked bags. Return to the classroom and pour the soil or litter into a large pan. Using forceps, carefully sort through the material. Identify any organisms, using field guides. Use magnifying glasses or dissecting scopes if needed.

- ***Insects***: Using the insect nets, make 3 sweeps of the 10 x 10 m square from corner to corner, being sure to brush the trees and shrubs with the net to disturb resting insects. Identify any insects collected, then release them. ***Watch out for bees, wasps, and hornets.***
- ***Birds***: Identify any birds in the vicinity of the study site.
- ***Mammals***, reptiles and amphibians: Look for tracks, burrows, or other signs of these animals in *or near* the 10 m x 10 m area. Identify the animal or its sign. ***Do not pick up any snakes.***
- ***Temperature***: Take the air temperature at head, shoulder, waist, knee, and ground level in the open, under a tree, and under a shrub and carefully record each reading in the notebook.
- ***Soil pH***: Take soil samples at the same locations as the soil and litter group. Follow directions of the soil pH kit.
- ***Rain***: On the first day, set out the rain gauge in the study site at a location that is not sheltered by vegetation. Check each day for any rain. Read and record.
- ***Relative humidity***: On the first day, use a sling psychrometer to determine the relative humidity at head, shoulder, waist and knee level under a tree, under a shrub and in the open of the 10 m x 10m area. Record wet and dry bulb temperatures. Then use a relative humidity chart to determine the humidity at each location. This test might be repeated at the end of the activity.
- ***Description***: Describe what the study site looks like. Try to paint a picture with words. Actual sketches also may prove useful.
- *Each student also is responsible for finding 10 ecological relationships and identifying them within the study area.*

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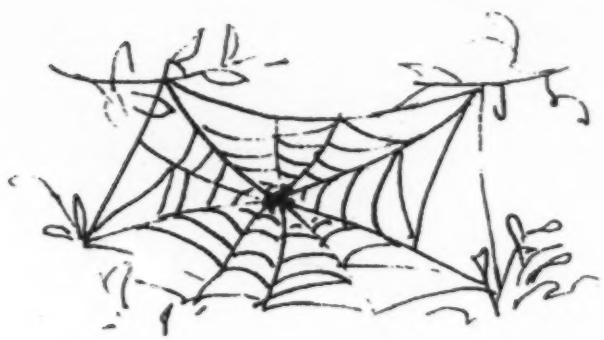
Gather data for 2 or 3 days. Return to classroom and share data. Soil and litter people will need to go through soil for organisms. Some groups may need help identifying their samples.

Method of evaluation:

A written paper from each student. The paper should include the following:

- ☒ Title
- ☒ Purpose
- ☒ Procedure of the student's own group
- ☒ Data of all groups in the class. This can be done as tables, bar graphs or pie graphs, as appropriate.



Discussion questions:

- ☑ Show the abundance and type of producers, consumers, herbivores, carnivores, and decomposers in the food web. This may be diagrammed.
- ☑ Using the information you have, construct an energy-flow diagram for the area.
- ☑ Discuss how the abiotic factors have an effect on the biotic factors.
- ☒ For the following, refer to your data with a minimum of 3 examples.
  - ☑ What ecological relationships did you observe? Give specific examples of each.
  - ☑ Describe the community structure, including any layers.
  - ☑ Describe the niche of one organism to the best of your ability.
  - ☑ Can you see any relationship between the abundance of an organism, its size and its place in the food chain? Explain.

Extension and reinforcement activities:

Students should use the organisms they found as reference points when discussing plants and animals later in the year. The site might be sampled at various times of the year to determine if there are seasonal changes.

This activity also could be repeated throughout the school year as the class studies different ecosystems -- such as fresh water swamps and marshes, forested uplands, marine wetlands, dunes, beaches, or areas that people normally think of as *useless* land -- such as marshland or upland scrub habitats.

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This exercise has been adapted, with slight modifications, from:
http://www.gene.com/ae/AE/AEC/AEF/1995/ sinclair_ecosystem.html